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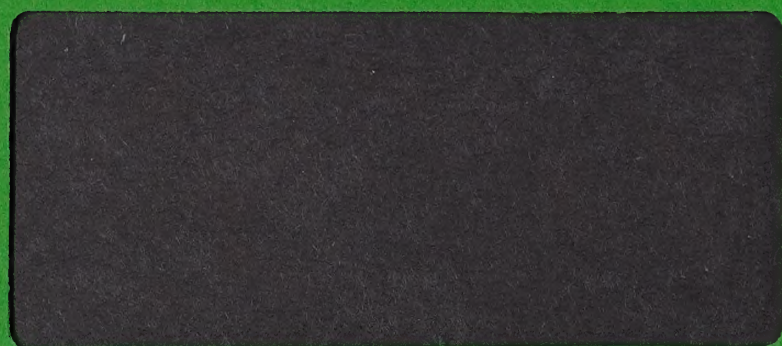


the ROYAL COMMISSION on the NORTHERN ENVIRONMENT

ISOLATED NORTHERN ONTARIO

PASSENGER RAIL

Funding Program Report



ROYAL COMMISSION ON THE NORTHERN ENVIRONMENT

J.E.J. FAHLGREN, COMMISSIONER

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ISOLATED NORTHERN ONTARIO

PASSENGER RAIL

by

Transport 2000, Ottawa

March 1980

THIS PUBLICATION HAS BEEN PREPARED WITH THE FINANCIAL ASSISTANCE OF THE ROYAL COMMISSION ON THE NORTHERN ENVIRONMENT'S FUNDING PROGRAM. HOWEVER, NO OPINIONS, POSITIONS OR RECOMMENDATIONS EXPRESSED HEREIN SHOULD BE ATTRIBUTED TO THE COMMISSION; THEY ARE THOSE SOLELY OF THE AUTHOR(S).



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1. Forward and Thanks

Transport 2000 (Ottawa Region/Outaouais) has prepared at my request, this brief for the Ontario Royal Commission on the Northern Environment and for the Canadian Transport Commission's Railway Transport Committee. This was made possible by the generous assistance of the Royal Commission on the Northern Environment, who granted more than \$3,000.00 for this essential work.

Transport 2000 Canada wishes to thank the RCNE for their cooperation and assistance.

Thanks are also due to former Minister Don Mazankowski for extending the service on the CN line for six months, six days per week, and to the CTC for deciding to hold hearings. The municipalities all along the line are to be congratulated for their interest and assistance, and the railway workers are to be especially mentioned for their concern for the well-being of their passengers. Citizens, officials, clergy, and business people who assisted in gathering and providing data are also warmly thanked for their cooperation.

At the eleventh hour, a short submission has come from an unexpected quarter. Mr. Robert Rynerson, an Edmonton passenger transport planner, has sent a note and suggested timetable, which are reproduced as is, as they would seem to be the essence of good sense. Mr. Rynerson's work can be found appended to the submission following the Researchers' report (section 4).

Finally, Mr. Robert Worrell and the Caisse Populaire Parc de la Montagne have been essential to the progress of this project. Indeed "Bob" Worrell has been the soul of the Transport

2000 Ottawa/Outaouais effort, and special recognition of this is due.

Harry W. Gow
President
Transport 2000 Canada

2. Staff (Volunteer and Paid)

Principal Investigator: Harry W. Gow, M.S.W.

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3. Introduction

The previous report on Future Remote Rail Access outlines briefly the railway and institutional history leading to the present Winnipeg-Capreol six days weekly truncated CN line regional service. The problem of people living in a roadless area with only train service for principal access is outlined. A survey of their needs are outlined. The report recommends daily passenger service and suggests certain improvements to improve speed, cost effectiveness, and usage. This submission to the Royal Commission on the Northern Environment and to the RTC of the CTC will expand on the previously mentioned brief. It includes a more detailed account of the research with reference to the CN rail line in Northern Ontario and will attempt to explore areas for which the schedules were not primarily designed, that of the economic impact and marketing evaluation. Some references will be made from time to time to the previous brief, and for the sake of simplicity be hereafter referred to as part I.

4. Researcher's Report (W. Robert Worrell)

Travel overview:

approximate mileage: 7,000 miles (3 trips)

dates involved: November 23-30

December 3-8

January 12-16

- November 23-24: Via Rail departure westbound
(preliminary) 24: Township of Wickstend meeting
25: interviews and recruitment of Research assistants
26: Via Rail westbound
Town Hall Sioux Lookout meeting
27: further interviews in community
28: briefing research assistant
Via Rail departure eastbound
29: meeting with "Save Our Passenger Trains Committee,"
Capreol
30: Via bound for Ottawa
- December 3-8: Via bound CTC hearings
(CTC hearings) 5: Sioux Lookout
6: Hornepayne
7: Capreol
- January 23-24: Via westbound
(follow up) 14: meeting Town Council, Nakina
15: meeting Transport 2000 Winnipeg
16: Via bound southern line, Winnipeg-Thunder Bay-
Ottawa

Previous to completion of part II of our study of Isolated Northern Ontario passenger rail, I have travelled in excess of 7,000 miles which represents three separate voyages. Approximately 1,000 miles of which were logged on the southern route to observe first hand the differences in marketing techniques illustrated by many during the hearing processes in December.

The first of three voyages has been outlined previously in the brief to the RTC of the CTC (ref pages 14-16). During this field work my objective was two fold; firstly to collect schedules (surveys) previously distributed and secondly to obtain information first hand by meeting with people of the committees concerned. It appeared necessary to indeed collect the schedules where possible in order that this process yield a larger and broader result than by mailed schedules.

The results of the surveys have been clearly documented and appended in full to this submission as have various reports and submissions received from other individuals and institutions during the process of CTC hearings.

My meetings with the people directly involved in Ontario remote rail were most encouraging and included stays in Capreol, Hornepayne, Nakina, Sioux Lookout and Winnipeg, as well of course long conversations on board with patrons from all along the line and indeed tourists from as far away as New Zealand. It was interesting to note a large percentage of Via's clientele were familiar with the route and missed the discontinued thru service to Toronto eastbound and facilities such as dayneters and regular dining cars. Some of the comments although harsh perhaps might be warrented with the knowledge of service available in the past and most assuredly so, if compared to the southern rail services found in the "magic corridor" and elsewhere. The meetings with the

residents of Hornepayne were demonstrative of some of the problems present with regard to capacity. At least two accounts were given involving leaving persons standing at stations due to space restrictions in the fall of '79 (taped interviews, Hornepayne). It was later discovered that even though an extra train was made available on Via's northern line during the Christmas season thru to Toronto, those patrons with destinations between Capreol and Toronto were in fact subjected to the ½ hour inter-city bus/train shuttle and not allowed to remain on the vehicle to detrain in Parry Sound, Orillia, Barrie, ect. Food was also an issue causing some dismay.

It became apparent, where there are no Macdonalds or other similar fast food chain, rail passengers have difficulty accepting this quality of meal on a train service operated in these areas. Such examples of culture shock were unappetizing and left a bad taste, of which it seemed might distract some continued patronage. It also seemed unusual that a school teacher from this area accounted to us that no train travel by students in the area was evident for several years, nor had there been any group travel in quite some time (curling clubs, senior citizens) according to the train conductor's accounts.

There was mention of snowmobilers, canoeists and grocery shoppers and the difficulty obtaining clear baggage tariffs for those individuals who used northern rail services in the past. Since some communities do not have facilities for obtaining groceries and baggage rates are unclear ("rumored" use of freight tariffs) some individuals utilize suitcases for their monthly shopping trips. Perhaps here we have received a lesson in ingenuity for the railroads to ponder. In the warm and friendly community of Sioux Lookout it became more possible to assess economic stimulus attributable to northern rail services.

With the assistance of a business consulting firm I attempted to obtain a further preview of rail economic impact in the north. The now familiar rail trips associated with acquisition of amenities for survival prised into several forms; shopping trips for hardware items, clothing, hospital services, entertainment and groceries for resort owners and remote settlers alike. This may be best understood after listening to the taped interviews. An outfitting store representative was able to tell us how he counselled back packers and canoeists coming into the area and had even supplied those utilizing remote rail services with instruction sheets for using the special railroad dispatching phones on the line for mileage stops on their return or in case of emergency. Another important example of rail utilization it seems was that of the youngsters from remote communities who were required to attend classes in larger centres and who returned to be with their families on weekends. In Nakina we discovered similar resource facilities for hunting and fishing which also depended on rail service for both clientele and supplies although to a lesser extent in summer with a highway close by. Here as in other communities north of the 50th parallel severe winters restrict road mobility and rail services offer an alternative however unattractive the on board facilities.

A broader view of remote rail service was discovered in Capreol where we heard of equipment failures attributing to delays and unpleasant journeys for rail passengers. Many delays seemed to be a result of bizarre operating practices requiring authorization and supply of replacement locomotives or bad order vehicles to be obtained some distance from where the problems occurred. (Toronto/Winnipeg) equipment placing procedures do not allow for enroute breakdowns. That is to say over 940 miles of railroad it is not possible to replace a coach with broken down "steam" heating system or a locomotive that surrenders due to harsh weather. This

might easily be remedied by simply following procedures elsewhere on the long distance routes. Appended to this report is additional schedule correlation received after completing^{of} the CTC public hearing process.

In brief summation I would like to thank the many residents in northern Ontario and the assistance of Via Rail Canada, as without them this report would not have been possible.

R. Worrell

3. SUMMARY

This report on Future Remote Rail Access outlines briefly the railway and institutional history leading to the present Winnipeg-Capreol six days weekly truncated CN-line regional service. The problem of people living in a roadless area with only train service for principal access is outlined. A survey of their needs is detailed, and appropriate means of serving the needs are outlined. The report recommends daily passenger service and suggests certain improvements to improve speed, cost effectiveness, and usage.

4. INTRODUCTION

In response to the call on 29 January, 1976, of the then Minister of Transport, the Honourable Otto Lang, P.C., M.P., the Railway Transport Committee of the Canadian Transport Commission held hearings across much of Canada on the subject of Western Transcontinental Railway Passenger Service. The hearings did not, however, cover the CN Northern Ontario line extensively, and the implementation of the CTC Final Plan, resulting from the hearings, had to be delayed for one year to allow "other means of transport" to be found, as area residents had objected to the reduction from daily service on the CN line from Capreol to Winnipeg. This was in October 1978. In October, 1979, the Honourable Don Mazankowski, the new Minister of Transport, ordered the service to be run on a six-day per week basis for a further six months, effective October 28, 1979 to permit hearings to be held in the area affected, in order to allow the CTC to learn of local residents' views and needs in a detailed manner.

Transport 2000's Ottawa region group submitted a request to the Ontario Royal Commission on the Northern Environment for a grant (of \$2,900) to permit payment of minimal wages and expenses to a researcher and assistants, as well as for printing, for preparation of a brief for these hearings. This request was granted and in the minimum time permitted since (1 week) the research team has covered nearly all the miles between Capreol and Winnipeg on the principal and local trains involved.

A questionnaire, in English and in French was distributed in 400 copies on trains and in settlements on the line (see Appendix I). Interviewers broadened the base of citizen needs with in-depth inter-

views and with interviews on commercial impacts of various past and projected service levels.

A fuller report will afterwards be supplied to the Royal Commission and to the CTC, the Minister of Transport, VIA, and others.

We are very pleased to come before the Railway Transport Committee of the Canadian Transport Commission once again, and hope that this Brief will be of assistance to the Commissioners in their deliberations. We look forward to the same fair hearing process and decision-making that have become the hallmark of this regulatory tribunal. Our only regret at this time is that the general supply of financial support to the CTC from Treasury Board has been more restricted than it might have been, and that this can lead to the Commission having more difficulty in processing all the evidence that is submitted at this and other hearings. We hope the Government will be more sympathetic to the people's needs for adequate, safe transportation, of which this committee is a principal guardian.

5. HISTORY

The Precambrian Shield area between Capreol and Winnipeg spans 930 miles, according to Transport Minister Don Mazankowski, though consultation of the VIA timetable reveals that exceptionally VIA does not print the mileages on the timetables in question.

This distance, nearly a thousand miles, was once covered, if at all, by Ojibway Indians in frail birch bark canoes.

Beginning in the 18th Century, whites showed an interest in the area, and until the coming of the railway, covered the area in the same manner as the Ojibways, albeit in large voyageur canoes. Even after the CPR construction era of the 1880's, the area along the "CN line" in question was largely unserved by mechanical transportation. The advent of the Canadian Northern Railway and of the somewhat parallel National Transcontinental - Grand Trunk Pacific Prince Rupert - Québec line in the period 1900-1910 opened the area up for such settlement as has occurred, and provided access to the earlier permanent residents, Sioux, Ojibway, and Cree.

With the formation of Canadian National Railways, the CNR transcontinental trains began taking a combined route, using the Longlac-Nakina cutoff. This led to the service pattern in effect to the present day, as to routing.

As to frequency, the service has seen better days. The line was graced with two transcontinental passenger trains daily in the 1950's and early sixties, the Continental and the Super Continental. The former was changed to the peak-season Panorama in 1964, but this

service was dropped in 1971. The basic once-daily transcontinental service has been supplemented by two local trains, one between Sioux Lookout and Winnipeg (twice weekly), and one between Capreol and Nakina (thrice weekly). These services are also the subject of these hearings, as is the Hornepayne-Mamtouwadge service.

On October 29, 1979, the daily transcontinental service over the line was discontinued, and replaced by a six-times a week service. This diminution in service, while unfortunate, is not as "bad" as the threatened thrice-weekly service foreseen in the CTC Final Plan, of October 1977.

A series of changes in service patterns over the last two years have resulted in the loss of direct access to Montreal and Toronto. Now, in order to get to either place by rail, users have to transfer at Capreol to a bus for a half-hour ride to Sudbury. The present service now has this "inconvenience barrier" separating it from the continental passenger rail network (and no doubt reducing its "saleability" to the prospective outside user). Transport user's associations have had their part in all of this. Transport 2000, for example, advocated thrice-weekly passenger service over this line in briefs in 1976, to the Commission. We only changed our opinion as to the needed frequency and through service when the local people protested in the early fall of 1978, against the proposed diminution of service.

Transport 2000 now supports the local population's desires, but did not consider that we would be justified in returning to the

Commission with this changed approach without this time surveying the needs of local residents. This we have done, and the methods and results will be outlined in this report.

6. THE PROBLEM

In terms of transportation geography, the CTC's Final Plan called for "coarsening"* the CPR main line by concentrating the long-distance passenger traffic on it. (Even usually-vocal Transport 2000 had originally supported this move.) The concomittant was that the CN line was reduced to a by-way with reduced frequency and poor access to the outside world.

In our follow-up report we shall detail some of the transportation geography theory about such initiatives. Suffice it to say that, for now, studies in the past have shown that strengthening "main lines" between metropoli can have the effect of reinforcing their relative economic position and growth, relative to subsidiary centres, and that concomittant de-emphasis on secondary routes will lead to stagnation and decline of secondary and lower level centres.

In the instance of the "CN line", the amount of parallel road within a km of the track is not more than 25 km, according to our visual check and the Ontario official road map, from the Manitoba border to Capreol, a distance of 1,100 km.

While parallel rivers, such as the Kaministiquia, might offer some possibilities of substitute transportation, this would only apply to expert canoeists with time on their hands in summer.

The survey team, based on personal trips and discussion with area residents, has drawn up a list of other means of transport in the area:

* Increase the traffic flow - the Final Plan calls for two sections of the transcontinental to operate over the CP line during the summer months

- snow-train
- snowmobile (snow-cat, "Skidoo")
- snowshoes
- cross-country skis
- canoes
- floatplanes (to a few communities)
- landplanes (to a few communities)

The last two are so expensive as to be financially inaccessible to the majority for most trips, and do not provide all-weather, all-days transport to all communities and stops on the line.

The other means of transport are too slow (or even dangerous) to be practical.

The problem may be stated to be one of inaccessibility for a small population in a remote area except by one mode, namely rail. The new rail travel arrangements are already restricting access into the area and even once a week within the area, compared to previous rail arrangements. One-mode entry is becoming increasingly restricted, and it appears that prospects would be for continuing restriction if the Committee does not have adequate information on a sufficient quantity and type of access needs out of, into, and across the area.

Transport 2000 considered it to be urgent to attempt to gain some idea of the volume of needs and the types of needs of residents and outsiders, and from that, propose a type of service.

7. THE STUDY

Hypothesis

The researchers hypothesized that people along the CN line would want to see a daily, or near-daily level of service. The reasons for this were eloquently attested to in the letter of the Anglican Bishop of Moosonee and in the letter from the Reverend Fr. Tom Corston (see Appendices II and III). The reasons include the inability to schedule accidents to suit VIA's schedules, the impossibility of carrying out essential ministerial work, shopping, recreational, family and other trips on a syncopated thrice-weekly schedule, with the layovers and hotel bills this will inevitably entail.

The Questionnaire

A questionnaire shown in Appendix I was designed for distribution for written responses, initially, and later, for use as a verbal interview at schedule as well, once funding was assured for an on-the-spot survey.

The questionnaire, printed in English on one side, French on the other, "asks" questions as to age, type of work, and number of children in family.

It goes on to inquire as to methods of transportation used, e.g., car, train, bus, and "other". Use (or not) of the train is covered, as is frequency of usage. Desired frequency, and perception of tariffs (Right? Too high? Too low?) are surveyed. Reasons for train use, and destination are also requested.

The questionnaire, while limited in scope and not highly sophisticated, was judged by the writers to be sufficiently free of bias and neutrally phrased enough to get the desired information as "cleanly" as possible. The questionnaire was a modified version of one used previously in a summer (1978) survey of bus user (and non-user) needs and preferences in the Farm-Point-Masham-Wakefield area of Québec. This 1978 survey was a success in that responses and patterns of response indicated that users understood, and responded in an un-influenced way to the questionnaire.

The questionnaire was sent to northern correspondents in the period November 15th to 20th, 1979, and site visits began on November 23, 1979, with the researcher and his assistants carrying out questionnaire-based interviews and non-questionnaire interviews over the districts in question along the CN line up to November 30, 1979.

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8. SURVEY PROCEDURES

In summary, the mail distribution of surveys was followed by visits to the area in question by the researcher. While normally the precise schedule and account of such work is not included in this type of report, the researcher's report on his activities is here given verbatim to illustrate the means used to gather our information. The researcher travelled 2,567 rail miles in the course of eight days.

Report of R. Worrell, Researcher

Stage One: November 1, 1979 (16 hours)

Work was initiated November 1, 1979 on adapting a (survey) schedule to be distributed in northern Ontario to aid in gathering information on the users of the train services between Capreol and Winnipeg.

Stage Two: November 15, 1979 (16 hours)

Letters were drafted and sent with copies of survey to be collected or returned by mail to us by November 27, 1979.

To: Reeve of Hornepayne, R. MacLellan

Mayor of Sioux Lookout, J. E. Parry

Chairman, Capreol Committee, "Save Our Passenger
Trains", N. E. Fawcett

President, Transport 2000 Manitoba, D. Osborne

National Indian Brotherhood, A. Goodleaf

C.B.R.T.G.W. Local 340, Mr. Tynes

Stage Three: November 20, 21, 23 (8 hours)

Follow-up phone calls to above regarding receipt of same and advice on how to use material if they so

desired and our requirements regarding this material.

As well arrangements to meet where possible their representatives in their locals on arrival.

Stage Four: Visits to Communities

November 23, 1979 - Depart Ottawa at 12:50 p.m. on Train No. 1 bound for (CP) station Sudbury to connect with VIA charter (ONR Bus) at 20:55 p.m. which took me to (CN) station Capreol, arriving there 21:25 p.m. where I boarded immediately Train No. 7, bound for Hornepayne. Arrival in Hornepayne November 24, 1979 at 5:15 a.m. on time with no place to go (watch out CTC commissioners). After discovering no taxi was available until 8 a.m. and the only Hotel in town was not generally open for business at train arrival times, I flagged a local resident and got a lift to the motel closest to the highway, expecting my check-in problems to be solved thus. After locating the owner by phone, I was checked in around 6:30 a.m.

My researching day began a little late, at approximately 11:00 a.m. with a call to the Clerk Administrator, Mr. Bernie Brouillard, who chauffeured me to the Town Hall. I was afforded their complete office facilities (photo copier, phones, council chambers) and after having set up my base operational facilities, I was treated to breakfast where I briefed Mr. Brouillard on my time and expectations during the brief stay in Hornepayne.

At 1:00 p.m. again with the volunteer assistance of Mr. Brouillard, we contacted and attempted arrangements for interviews with as many members of the community as a twenty-four hour operation would allow. This resulted in the taped interviews with the three gentlemen from Hornepayne who represented the large rail employee population in this area. Additional volunteer help was afforded by these gentlemen in distribution of the surveys in the community.

As my intention had been to proceed by train to Nakina the morning of the 25th, where I was to recruit an additional researcher. Due to unforeseen circumstances (entertaining by local officials until 11:30 p.m.), I missed the departure on the 25th and lost 24 hours from a very tight schedule which necessitated recruitment be from Hornepayne.

November 25, 1979 - After breakfast, I again contacted Mr. Brouillard to gain assistance in locating an additional helper to conduct oral interviews and distribute and collect surveys for three days on Trains 676/675 between Nakina and Capreol. After contacting

fifteen local residents, I was able to interview two residents for this position. Because of the familiarity with the service and a certain perceptive ability, I decided on a student from Hornepayne, Mr. Cyril Beaurepaire. With my guidance, he established an interview hypothesis. He departed on Train 676 at 12:00 (noon) on November 28. He returned on Train 675 November 29 departing Capreol at 9:00 a.m. and arrived in Hornepayne at 5:30 p.m. The results of his efforts were deposited in an envelope addressed to myself to be picked up at the baggage room in the Capreol station which I would retrieve before my return to Ottawa on November 30.

November 26, 1979 - I departed Hornepayne at 5:35 a.m. en route to Sioux Lookout in a sleeper on Train 7. The daytime hours were spent interviewing VIA and CN staff on the train and distributing and conducting surveys. Arrival in Sioux Lookout at 2:15 p.m. was ten minutes late. Upon arriving, I contacted Mayor John Parry to arrange a meeting and a recommendation regarding hotel accommodations. The Mayor was most helpful in arranging for resources appropriate to my requirements - office and local people in the community who might have a broad overview of the user needs for rail services. My first visit was to the Sioux Lookout Indian Friendship Centre to brief this organization on the efforts of Transport 2000. The remainder of Mr. Worrell's report will be in point form to conserve space and time.

November 27, 1979

A.M. - shopping for tapes and film, banking

P.M. - interviews with an outfitting company representative, children's aid supervisor and WAWATA NEWS (Northern Native News Service)

November 28, 1979

A.M. - photographing Sioux Lookout, station facilities, Train 8

- reviewing material relating to flag stop procedures

P.M. - recruiting and briefing business consultant to perform interviews illustrating social and economic impact of rail passenger service in Sioux Lookout

- departed on Train 8 at 3:30 p.m:

- interview in bar with Armed Forces personnel (on tape)
- interview in Cafe Bar Lounge over supper with tourist from New Zealand (on tape)
- distribution and collection of surveys with assistance of train conductor

November 29, 1979

- A.M. - arrival in Capreol at 10:20 fifteen minutes late
- met by representatives of the Capreol "Save Our Passenger Trains" Committee
- check into hotel
- tour of Capreol/Sudbury area to see community facilities
- P.M. - meeting with "Save Our Passenger Train" Committee in City Hall (on tape)

November 30, 1979

- A.M. - return to Ottawa on Train 2

9. THE SURVEY

Three hundred copies of the questionnaire were sent ahead of our researcher, and given to community residents and train users along the line. While the latter respondents could bias the survey, under the circumstances, for most along this line, the train is the only means of transport for east-west travel. Sometimes it is the only means of travel.

An analagous situation would be a travel survey emphasizing walking in a mountain village with only footpaths for access. Researchers would normally visit people at home and on the footpaths to find out about travel habits and needs.

The rest of the questionnaires* were taken with the researcher, and given out in some cases, and administered by himself directly in other cases. Generally, respondents filled in the forms for themselves and were assisted only if having difficulty understanding or reading them.

Return of 114 responses out of 400 questionnaires is considered a high response rate (greater than 25 %) in surveys of this sort.

*One hundred (100).

10. THE RESPONSE

Summary results of our survey are set out in tables below.
Comments generally follow.

TABLE 1

a) To get to outside centres, how do you travel?

MODE	NUMBER
Car	67
Bus	21
Train	98
Air	8
Ski	1
TOTAL	195

Note: Total exceeds number of returned questionnaires, due to some respondents indicating use of more than one mode.

The responses to this question reveal the dependance of area residents on the railway passenger service. The railway is the dominant mode, without question. Even the automobile does not equal rail in this tally. On the other hand, the users must be dependant on the train (hence vulnerable).

b) To get to outside centres, how do you travel? (Inter-modal breakdown)

MODE	%
Train	34.8
Car/Train	32.2
Car	10.4
Car/Bus/Train	4.3
Car/Bus/Train/Plane	4.3
Bus/Train	3.5
Car/Train/Plane	2.6
Car/Bus	1.7
Car/Plane	1.7
Bus	0.9
Bus/Plane	0.9
Bus/Train/Plane	0.9
Plane	0.9
Train/Plane	0.9
TOTAL	100

TABLE 2

Did you know about the CN (VIA) passenger train to Capreol and Winnipeg?

	NUMBER	%
Yes	105	92.1
No	5	4.4
No response	4	3.5
TOTAL	114	100

The ninety-six (96) per cent respondents knowing of the railway, would be considered high in the South. For example, Mr. Pierre L. Charron, writing in Sécurité Transports, No. 2, hiver 1979, "For many Québécois, trains belong to the folklore of things of the past, ...on the pretext that they don't use them to get around..." The same could be said of most civil servants in the Federal Ministry of Transport in Ottawa, from our observations.

This survey question reveals a high degree of awareness of the train, even allowing for a few "yesses" from people who wouldn't perhaps want to appear ignorant as the next question will validate this high degree of awareness.

In other words, use rates below will provide a clue as to why people are so aware of this service.

TABLE 3

a) Do you use the train?

	NUMBER	%
Yes	107	93.9
No	7	6.1
TOTAL	114	100

b) Do you use the train?

NO. OF TIMES	%
1 per year	3.5
2 per year	7.0
3 per year	1.8
4 per year	7.9
5 per year	4.4
6 per year	3.5
7 per year	1.8
8 per year	3.5
10 per year	0.9
14 per year	0.9
1 per month	13.2
2 per month	14.0
3 per month	2.6
4 per month	7.0
6 per month	2.6
8 per month	1.8
9 per month	0.9
10 per month	1.8
16 per month	0.9
20 per month	1.8
Yes, but frequency unstated	12.4
Don't use train	6.1
TOTAL	100.3

An examination of the above responses indicates that the most frequent responses are for "twice a month" (14.0%), and "once a month" (13.2%), as well as "yes - but frequency unstated" (12.4%).

If placed on a graph, train usage rates would be seen to work out to a normal curve, with the mode at "twice a month".

These use rates are higher than those for other classes of the general Canadian population, if Statistics Canada information is any guide.

TABLE 4

Is a six day-a-week service often enough?

	%
Yes (Respondants were regular travellers, one trip or more per month)	19.3
Yes (Respondants were other travellers, less than one trip per month)	18.4
Yes (Respondants' travelling frequencies unknown)	6.1
No (Respondants were regular travellers, one trip or more per month)	26.3
No (Respondants were other travellers, less than one trip per month)	16.7
No (Respondants' travelling frequencies unknown)	4.4
No response (Respondants had no comment)	8.8
TOTAL	100

TABLE 5

a) Would three days a week be often enough?

	%
Yes (
Yes (Respondants were regular travellers, one trip or more per month)	4.4
Yes (Respondants were other travellers, less than one trip per month)	0
No (Respondants were regular travellers, one trip or more per month)	37.7
No (Respondants were other travellers, less than one trip per month)	34.2
No response (Respondants had no comment)	23.7
TOTAL	100

b) Would you prefer once a week?

	%
YES (Respondants were regular passengers)	0
YES (Respondants were other passengers)	0
NO (Respondants were regular passengers)	30.7
NO (Respondants were other travellers)	26.3
NO RESPONSE (Respondants had no comment)	43.0
TOTAL	100.0

c) Would you prefer twice a week?	a
YES (Respondants were regular passengers)	0.9
YES (Respondants were other travellers)	0
NO (Respondants were regular travellers)	26.5
NO (Respondants were other travellers)	25.7
NO RESPONSE (Respondants had no comment)	46.9
	<hr/>
TOTAL	100.0

An attempt has been made to clarify the type of user answering the various frequency of use questions. For our purposes, it is significant to note that 47.4% of the people surveyed said that 6 times per week serving was "not often enough". Controlling for those who gave no response (8.8%), these "NO's" constitute more than half the responses.

Those most opposed to six-day per week (only) service, and implicitly wanting daily service were those making one trip or more per month, who constituted 26.3% of all responses on the "NO" side, as opposed to 19.3% on the "YES" side.

While not absolutely overwhelming, this tendency confirms the contention of the Bishop of Moosonee, and of one of his clergy, Rev. Fr. Tom Corston, that the one-day of "No Train" per week is a menace to some people's personal and work patterns, such as the clergy's.

TABLE 6

Are the fares right?	%
YES (Respondants were regular travellers)	29.2
YES (Respondants were other travellers)	24.8
TOO HIGH (Respondants were regular travellers)	11.6
TOO HIGH (Respondants were other travellers)	7.1
TOO LOW (Respondants were regular travellers)	0
TOO LOW (Respondants were other travellers)	0
NO RESPONSE (Respondants had no comment)	27.4
TOTAL	100.1

This set of responses was something of a surprise to the researchers, who had expected more resistance to current minimum fares. Our question was, however, not understood by many respondents (No Response 27.4%) and the question had to be verbally explained to many persons who weren't aware of the "VIA minima" (\$4 and \$8 return).

TABLE 7

a) Is a \$4 minimum fare too high?	%
YES (Respondants were regular travellers)	10.5
YES (Respondants were other travellers)	2.6
NO (Respondants were regular travellers)	29.8
NO (Respondants were other travellers)	28.1
NO RESPONSE (Respondants had no comment)	28.9
TOTAL	99.9
b) Is a \$8 minimum return fare too high?	%
YES (Respondants were regular travellers)	13.3
YES (Respondants were other travellers)	2.7
NO (Respondants were regular travellers)	25.7
NO (Respondants were other travellers)	24.8
NO RESPONSE (Respondants had no comment)	33.6
TOTAL	100.4

Some potential users may well be staying at home in their tiny settlements because of these fares, and hence missed by our survey which was carried out on board and, mostly, in larger settlements.

It is significant that the above VIA fares do not now apply to the Mont-Laurier, the Havelock, and the E&N services, due to the desire to maximize carryings and hence revenue, in at least the Mont-Laurier and E&N cases.

The Railway Transport Committee has suggested for the Prince Albert-Saskatoon-Regina service and for the Dominion Atlantic Railway service that the minimum fares be reconsidered.

We would ask the R.T.C. to make the same request of VIA in the present case. We would also ask VIA to forget these minimum fares here especially, and indeed, all across Canada.

TABLE 8

a) Ages of respondents	0 - 19	6.0 %
	20 - 29	30.1
	30 - 39	22.4
	40 - 49	11.2
	50 - 59	17.2
	60 Plus	8.6
	Unknown	4.3
		<hr/>
		99.8*

*Discrepancy due to rounding.

TABLE 8 (Cont'd.)

b)	Why do you use the train?	0 - 19 years of age
	Work	26.7 %
	Shopping	13.3
	Visit doctor	6.7
	Visit hospital	6.7
	Visit relative	20.0
	Recreation	20.0
	Other	6.7
		<hr/> 100.1 %
		20 - 29 years of age
	Work	20.8 %
	Shopping	15.6
	Visit doctor	13.0
	Visit hospital	9.1
	Visit relative	23.4
	Recreation	18.2
	Other	0
		<hr/> 100.1 %
		30 - 39 years of age
	Work	11.3 %
	Shopping	15.5
	Visit doctor	21.1
	Visit hospital	11.3
	Visit relative	21.1
	Recreation	16.9
	Other	2.8
		<hr/> 100.7 %

TABLE 8 (Cont'd)

Why do you use the train?	40 - 49 years of age
Work	15.8 %
Shopping	10.5
Visit doctor	18.4
Visit hospital	7.9
Visit relative	23.7
Recreation	18.4
Other	5.3
	<hr/> 100.0 %

	50 - 59 years of age
Work	13.5 %
Shopping	19.2
Visit doctor	15.4
Visit hospital	11.5
Visit relative	23.1
Recreation	13.5
Other	3.8
	<hr/> 100.0 %

	60 plus (years of age)
Work	0 %
Shopping	8.3
Visit doctor	20.8
Visit hospital	16.7
Visit relative	20.8
Recreation	20.8
Other	12.5
	<hr/> 99.9 %

According to the "official line", from the M.O.T. civil servants, resistance to train service reductions comes mainly from "train buffs" and from nostalgic persons who travel by automobile.

The relative youth of the persons surveyed, nearly all of whom are train users, and the purposes of trips should help refute this. Work, visits to relatives, recreation and shopping were the most frequent motives for train travel.

Below, we give some numbers of trip purposes for some age groups. There does not seem to be enormous variation by age, except that those over 60 were not making work trips, and made less shopping trips than other age groups.

Medical purpose (doctor and hospital) trips are often mentioned.

TABLE 9

a) Where is your destination?

FROM HORNEPAYNE TO:	<u>Number</u>	<u>Per Cent</u>
Toronto	26	41.9
Capreol	18	29.0
Felix	4	6.4
Winnipeg	3	4.8
La Forest	2	3.2
North Bay	2	3.2
Shekak	2	3.2
Foleyet	1	1.6
Montreal	1	1.6
Nakina	1	1.6
Shawmer	1	1.6
Sudbury	1	1.6
TOTAL	<u>62</u>	<u>99.7</u>

TABLE 9 (Cont'd.)

b) Where is your destination?

FROM SIOUX LOOKOUT TO:	<u>Number</u>	<u>Per Cent</u>
Winnipeg	17	56.7
Capreol	4	13.3
Toronto	4	13.3
Armstrong	2	6.7
Sudbury	2	6.7
Foleyet	1	3.3
TOTAL	30	100.0

For the above origin and destination tables, we broke out the data for those travelling from Sioux Lookout and for those travelling from Hornepayne.

The two communities in question are intermediate between Capreol and Winnipeg, but Sioux Lookout is nearer the western end of the line, and Hornepayne, further east.

While between the two, there may be a travel watershed, a number of travellers, it can be seen, are headed for Toronto or intermediate points from Sioux Lookout. A break in the middle of this service would render it useless for these people.

The number of people going to Toronto becomes dominant "from Hornepayne" (and this leads us to suggest that the bus "connection" at Capreol-Sudbury is a useless barrier to free, convenient movement, and may depress passenger train usage, and hence economic hopes for this service.

COMMENTS FROM RESPONDANTS:

"I've heard that conductors have had trouble with CN employees that have to ride the train often. However, I don't believe that they should be so disrespectful and miserable towards nice guys like myself. I've met a lot of regular passengers that feel the same way about most conductors, and I think it would be a very good idea to conduct a survey of how passengers feel about conductors that they've talked to."

- Apprentice Lineman

"I could drive to Sudbury or North Bay for the same price as the present train fare and still have the convenience of the car after arrival."

- Student

"With the coming up of not enough energy, it should be the way to travel in the future."

- CN Employee

"Considering the lack of transportation in the north they should improve services as in passenger trains instead of dismantling services..."

- Trainman

"It is important to have a train everyday for people in other small places on the line. It may mean their lives - to have a train running everyday."

- Counsellor

"The present 'service' is very inadequate for our community and others along the line. If the service was improved - encouraging people by providing good service - perhaps more people would utilize it."

- Secretary

"CN passenger service is the only viable public transportation for a very large portion of this and neighbouring communities. The 'temporary' schedule is not only unsatisfactory but also is discouraging use of the so called service, therefore not giving a true picture of the need or desire to make use of the rail passage..."

- Social Worker

"Since VIA took over the service has been the absolute pits."

- Secretary

"I feel that as we are 40 miles from the Trans Canada we could be classified as a semi-isolated community. Many people in this area do not have cars and rely solely on rail service, therefore service should be increased rather than decreased. Also service to Thunder Bay should be a major concern as well."

- Welfare Administrator

"In my position with Children's Aid, many clients I know use the train as their sole means of transportation to Sioux Lookout (hospital, shopping, visiting, etc). Cutting VIA service to less than 6 or 7 times per week would be a grave injustice to these communities and would make it very difficult for social service agencies dealing with clients in inaccessible places."

- Social Worker

"Would happily travel by train if service were improved. Bad-tempered conductors and bar attendants main reason for hesitating to use service."

- Accountant

"Appreciate senior citizen rate. Can adjust to reasonable timetables. Stewards lack polish."

- Senior Citizen

"This train is the only available means of transport for some people who do not have other means of transportation, and in northern Ontario should be kept on their benefit and also my own whether I own a car, airplane or bus."

- Brakeman

"Son attends Waterloo University. If the train is discontinued it will mean that the people will have to move closer to civilization. The train should be reinstated running straight to Toronto and Montreal separating as before at Capreol. The last trip on November 9, 1979 made by us was total disaster. Winnipeg train late. Missed connections at Sudbury. Bussed by Greyhound to Toronto in crowded bus. Missed connection in Toronto. Last bus and train gone, so missing all appointments made prior to departure. The services offered VIA I consider are an insult to the citizens of the north."

- Car Salesman

"During the winter months the train is the only way out during severe conditions. With a large family and gas priced so high it is again the only feasible way out."

- Locomotive Engineer

"You know for a fact it can't be worse. People right now feel the service is a deliberate act to discourage the passenger train. Unfortunately VIA has done nothing for us up in the north."

- Clerk

"I myself depend on this train to get me to Barrie. The way it is now is almost impossible for connections. It is very, very disappointing. VIA should never of took it over."

- Secretary

"Double booking as you do has stung me on my last two trips to Toronto. On my last trip to Toronto, 12 people, myself and my wife included, were forced to sit in the lounge and bar car from Hornepayne to Foleyet before coach seats were available. Clean up your act."

"When you have a young family train service is essential to get to medical services."

- Clerk

"VIA Rail is purely outdated. Equipment is not reliable or comfortable. Schedules are too slow, prices too high. It is the worst method of transportation in the world."

- Transportation Employee

Summary of Responses

The 114 people responding appeared to be normally distributed over the adult age curve. 74 (64.9%) were men, and 36 (31.6%) were women. Four (3.5%) did not state their sex. A bare majority of those replying thought six days per week service was not sufficient. Opinions on fares are harder to read, because people did not always understand the question.

A majority were train users. They use the train for essential life functions, such as work, shopping, and medical visits. People travel towards both Winnipeg and Toronto from Sioux Lookout, and to Toronto from Hornepayne.

Needs Analysis

The train would appear to fill, among others, the same needs as a local bus or train service in the South. In southern centres, officials will often try to reduce such services. The more numerous residents in those areas often have more luck in making themselves heard than do the dispersed Northerners. If, however, the numbers of the residents are smaller, it does not follow that their needs are any less pressing, or that the frequency of occurrence of these needs, is any less.

The persons we have surveyed have rejected the thrice-weekly service proposal. They also reject the six-day per week service proposal, though with a little less force, yet no less logic. Daily service would appear to be the only pattern that will meet the most acute needs fully. Accidents, childbirth, and illness respect no schedule. Can doctors,

clergy, linemen, and police serve their clients full-time on a part time train schedule? They have told us- the answer is "No".

11. EUTURE REMOTE RAIL ACCESS

1. Frequency

Seven days per week.

2. Access and accommodation

Through Winnipeg - Toronto service. Comfortable, full-service accommodations. Perhaps faster, certainly on time.

3. Schedules

Two proposed schedules are submitted.

OPTION I - more economical, less "regular".

OPTION II - More regular, easier to memorise.

DAILY Toronto through run.

Complements timing of Canadian on joint line.

We prefer and commend OPTION II.

PROPOSED SCHEDULES
FOR NORTHERN ONTARIO SERVICES

OPTION I

A TRI- WEEKLY	A TRI- WEEKLY	B QUAD- WEEKLY	←	NOTES FREQUENCY	→	B QUAD- WEEKLY	A TRI- WEEKLY	A TRI- WEEKLY
		2359 0730	Dp Ar	TORONTO CAPREOL	Ar Dp	0730 2330		
	0750 1520 1855	0750 1520 1855	Dp	CAPREOL HORNEPAYNE NAKINA	Ar	2300 1530 1215	2300 1530 1215	
0800	2145	2145		ARMSTRONG		0910	0910	2310
1050		0210		SIOUX LOOKOUT		0350		2010
1945		0730	Ar	WINNIPEG	Dp	2200		0900

OPTION II

A TRI- WEEKLY	B DAILY	←	NOTES FREQUENCY	→	B DAILY	A TRI- WEEKLY
	2359 0730	Dp Ar	TORONTO CAPREOL	Ar Dp	0730 2330	
	0750 1520 1855 2145	Dp	CAPREOL HORNEPAYNE NAKINA ARMSTRONG	Ar	2300 1530 1215 0910	
0730 1320	0210 0730	Ar	SIOUX LOOKOUT WINNIPEG	0350 2200	2330 1710	

NOTES:

- A - Local service providing baggage and coach service. Light refreshments on board or stops at stations of suitable duration for passengers to procure refreshments
- B - Full service train providing baggage, coach, sleeping car and meal (sit down diner style) service.

3. Schedules (continued)

Less satisfactory adaptation of OPTION II would provide daily connection with Canadian at Sudbury, thence on from Capreol, faster than at present.

4. Bus "connection"

The very disruptive bus shuttle should disappear.
Direct through Toronto service should be returned to.
"Dis-connection" by bus discourages patrons, depresses loadings.

5. Equipment

Replace ex-CN equipment with ex-CP stainless steel cars.
Advantages: Disk brakes, faster deceleration. Lighter.
Skyline dome will provide meals, views, lounge space.
Sleeper, coach equipment from same pool, refurbished.
Refurbished Park car would provide accommodation, lounge, views for first class passengers.
Equipment must be wired for electric heating.
Borrowed electric HEP equip. should be tested in winter on this line (source: Amtrak, Tempo, or GO Transit.)
New order of electric HEP equipment should be locally made at Thunder Bay. See text and illustrations of proposed equipment in following 1976 Policy Statement by Transport 2000, pp. 19 & 21.

6. Marketing.

Line must be promoted in region and beyond. Examples- Agawa Canyon run, Polar Bear Express, P'tit Train du Nord, BCR. Special fares, charter groups, school trips to be solicited, by VIA with help from Province, regional development bodies.

6. (continued)

Minaki Lodge and other resorts must be promoted - destination resorts are coming back into vogue. Ski trails, ski-do trails, snowshoeing, trapping, fishing, camping, swimming and canoeing must be developed further and promoted.

7. Consultative Committee

Representatives of C.T.C., municipalities, districts, Indian bands, Transport 2000, and others should meet frequently to assist VIA.

Precedent:- D.A.R. and Prince Albert - Regina services.

8. Minimum (?) fares

Present "minima" discriminate against short-haul users. Is a tax on those who have no other travel means. Should be replaced by new one-dollar minimum.

Precedent: C.T.C. has $\sqrt{}$ already advised against \$4 - \$8 "minima", in D.A.R. case, PA- Regina case.

9. Stations

Shelters must be heated, lighted, at all regular and flag stops. Main stations should be staffed and kept open. CN wants to abandon many Ontario stations. Perhaps Mr. Bob Bandeen would like to try waiting 5 hours for a late train in the open in 40 below weather.

10. Supervision

C.T.C. should regularly inspect safety and service quality, hand out complaint forms to passengers. Users must learn to complain, write C.T.C, M.P.s, T2000.

10. (continued)

VIA passenger service representatives (PSA's) should be assigned to train for security and social animation. VIA may refuse for cost reasons. Province should then appoint representatives.

Lack of supervision of safety, passenger deportment, employee performance, and railway co-operation may lead to a "social MISSISSAUGA" on this run. Montreal is far away.

11. EXPERIMENTAL PERIOD

Following the setting-up of a consultative committee, under CTC-VIA patronage, a period of one year, with new pricing, service levels, and Toronto connections (not "bus-ted" dis-connections), a period of one year's experimentation should be formally mandated. Results of this period would be carefully monitored, and analyzed with relation to the amount of effort put into the service by VIA and the Railways. At the end of the period, formal reports would be made to the CTC by VIA, the consultative committee, and others at an open hearing.

During the experimental period, an electrically-heated train should be tried out during the coldest part of winter. Coaches and other cars of this sort would be available from Southern Ontario (a sleeper might be borrowed from Amtrak).

13. CONCLUSION

A Precursor: Alfred, Ontario

As long as small communities are along a "main line" of communication provided local stopping is permitted, whether on rail or road, a level of accessibility and prosperity may be assured.

When this service is concentrated on another line, the small communities on the disfavoured line are naturally affected negatively.

One of the authours carried out a study at Alfred, Ontario, after the Trans-Canada Highway traffic was transferred from Highway 17 to Highway 417, bypassing the village of Alfred, pop. 1,200. This place had lived partly from the income from selling services, food, and gas to travellers. When the traffic was diverted, business volume at Alfred dropped by a proportion of 10 per cent to 90 per cent, depending on business type and location. Several restaurants and gas stations, bankrupted, closed.

A concentrated political campaign won essential highway junction signing changes, and with concentrated advertising and a media campaign, enough traffic was won to save the surviving businesses.

Interpretation:

As at Alfred, so in the North. The prosperity of many towns along the CN line has depended not just on rail employment, but on outside railborne visitors. When hundreds of people daily spend an hour in a village, the cash registers

fill rather faster.

The present winnipeg to Capreol service puts the CN line communities on a sideline. Employment and prosperity will decline. Accessibility is reduced. Some people will be forced to move. The example of Brent, Ontario, ^{which} lost key service personnel when the Super Continental was moved off the line may serve as a warning. The postmistress left on the very last train, saying "No Super C? No postmistress!"

In the case of many people living on the line, the alternative to a cabin in the woods and a life in the great outdoors would be atonement in Toronto or Winnipeg. The woods of Northern Manitoba are emptying into the slums of the cities. Does this have to be repeated in this area?

The bottom line here is human, sirs. Please forget Treasury Board strictures and MOT pressures, and do think, as we are confident you will, of the humans living along the line.

DOCUMENTATION; 14.

Oral

Our researcher, Mr. Worrell, has travelled intensively and spoken with many people living along the line. Space did not permit a detailed account of this, nor did time, but he will be available for cross-examination.

Recorded

We are providing, as an integral part of this document, a ~~tapescript~~ of parts of several interviews. Social and economic needs are documented therein. We ask your patience in listening to these excerpts.

Print

We are providing, in an appendix, some documentation, including briefs by other interested parties. We agree with almost all the observations therein, and would ask that these letters and briefs be included in the record of the hearings.

Policy Statement

A 1976 Policy Statement by Transport 2000 is appended.

NOTE: The discrimination against the rail mode, and the financial scrutiny so intense, that all passenger rail services in Canada operate at a disadvantage vis-à-vis the bureaucracy's one-sided accounting methods. The poor average financial of remote rail services returns/(as opposed to their sterling social benefits) so drag down the average results of rail passenger services, that we beleive that they should be subsidized and accounted for completely separately from other rail services, and given enriched funding from taxes on gasoline and other petroleum

products. Criteria of social service, reliability, and economic contributions to the areas served should be applied, and not, the now-discredited "User-pay" theory. Treasury's policy of higher fares for less service should not prevail.

This separation of remote rail budgeting from other passenger rail budgets would relieve the total network of lower financial performances averages, and would facilitate the granting of a new, higher level of support for the essential remote services.

STUDY ON CN LINE PASSENGER SERVICE

Sex _____ Age _____ Type of Work _____

Workplace _____ Number of Children at Home _____

1. To get to outside centres, how do you travel?

Car ()

None ()

Bus ()

Other (Name) _____

Train ()

2. Did you know about the CN (VIA) passenger train to Capreol and Winnipeg?

Yes ()

No ()

3. Do you use the train?

Yes ()

No ()

No. of times a month ()

a year ()

Where to go? _____

4. Is a 6 day-a-week service often enough? Yes () No ()

5. a) Would three days a week be often enough? Yes () No ()

b) Would you prefer once a week? Yes () No ()

twice a week? Yes () No ()

Why? _____

6. Are the fares right? () Too High? () Too Low? ()

7. Is a \$4 minimum fare too high? Yes () No ()

Why? _____

Is a minimum \$8 return fare too high? Yes () No ()

Why? _____

8. Why do you use the train (if you do)?

() Work

() Visit relative

() Shopping

() Recreation

() Visit doctor

() Other

() Visit hospital

() What? _____

9. On your trips on this train, where is your destination:

Toronto () Capreol () Sudbury () Winnipeg ()

Other () Name of place _____

Your other comments: _____



THE CANADIAN TRANSPORT COMMISSION
1000 AVENUE D'OTTAWA
OTTAWA, ONTARIO K1P 6K6

APPENDIX II

THE RAILWAY TRANS. OFT. COMMISSION

Hearing in Huronpayne, Ont.- Thurs Dec. 6/79

Re: Final Plan of Western Transcontinental Passenger Train Service:

In a Brief to the Canadian Transport Commission in March 1976 and again in a letter dated October 1979, I have made my objections known to the proposed change of service on the C.N. Northern line.

My knowledge of this area dates from 1944, when I served the Anglican Church in the Geraldton district. For the past 17 years as Bishop of the Diocese of Moosonee (in which many of the places effected, are situated), I am charged with the oversight of the people "on the line". At least once a year, I visit these small isolated communities and know both the people and their problems as they live on the steel edge of Canadian life.

I also am much aware of their dependence on train service. Its affects many facets of their life. The passenger service presents both a way out and a way in to isolation. Yet it is more than a method of transportation. . . it is a symbol and a touchstone with something other than a tiny community. It is the idea, as well as the fact, that makes living tolerable. If the service discontinues on a daily basis, it isn't just the lack of transportation but the destruction of the idea that will be a great blow to their living.

It will affect the education procedure of their families. Once children have progressed beyond the level of the local one room school, they must go to one of the larger centres for their education. It is invaluable to both the students and parents (from both a social and economic point of view) that they be able to spend their weekends at home. The proposed change will successfully block this vital link.

It has its health facilities. For people's well-being, we have a carefully program illness and accident on the on most day so that they can go to the doctor and hospital of their choice.

It is also true, as far as we are concerned, that it is difficult and to our administration to these people. . . not only Anglicans but other religious as well. All of us perform a travelling ministry which, at best, is difficult and becomes virtually impossible. This ministry is one of long standing and not only provides the focal point of religious expression but is often the only sound board of an isolated, powerless group.

I can only reiterate what I have said in my most recent letter.

"These are people and because of their isolation (many live there in order to keep the rail line operative!) they desperately need every service we can possibly give them.

I would like to think that the Canada I know is also based on this premise. It is true that these people have no political clout, they are economically underprivileged. . . there is no power they can wield, but God help us if economics is the sole criteria of judgment. We may balance our ledgers, but here is a human ledger that means far more."

I will be unable to be at the hearing in Hornepayne on Dec. 6th, but will be represented by the Rev'd Tom Corston who is one of our "line priests", covering the area between Long Lac and Savant Lake.

William Bishop

November 28, 1979.

Dear Sir:

I plan to attend the hearing of the CTC set for Thursday, December 6th, in Hornepayne. I hope to be able to present this submission and present my views to that hearing at that time. I will also be representing The Most Rev'd. James A. Watton, Archbishop of Moosonee, Anglican Church of Canada, at that hearing. The Archbishop has already sent to you his submission. I hope also to present his submission at the said hearing.

Yours sincerely,

Yours sincerely,
Willard Van +

cc. Mr. Gabriel Fortin, Montreal, Quebec
Mr. Harry Gow, Ottawa, Ontario
Mr. John Rodriguez, MP, Ottawa, Ontario
The Corporation of the Town of Sioux Lookout

"In the wilderness prepare the way of the LORD. . . ."

Notes on northern Ontario CN Line Service:

The Courier/Le Coureur: an attempt at a VIA-CN style name appropriate for this service. Inference in English is of a messenger, in French of the trappers, hunters of the woods?

Connections abound on this schedule.

TORONTO:	To/From Buffalo, Windsor, Sarnia, Stratford, Niagara Falls, Ottawa, Montreal. Sunday from Havelock.
SUDBURY:	To/From Trains 185/186 by taxi link.
OBA:	From Sault Ste. Marie to Winnipeg. From Hearst to Toronto, loose connection.
HORNEPAYNE/ CAPREOL	From Toronto to Train 675 (or adjust 675 to connect at Capreol. Lv 1000.) From Train 675 to Toronto.
HORNEPAYNE:	From Train 270 to Winnipeg.
NAKINA:	From Train 273 to Winnipeg. To Train 272 from Winnipeg.
SIOUX LOOKOUT:	<u>Loosely</u> From Train 277 to Winnipeg. <u>Loosely</u> To Train 278 from Winnipeg. <u>Loosely</u> From Toronto to Train 287. <u>Loosely</u> To Toronto from Train 286.

This package could be improved by running an RDC tri-weekly from , Thunder Bay to Winnipeg via Sioux Lookout, with arrival in Winnipeg at 2100. Departure from Winnipeg at 0830. It would cover the times now run by Trains 7/8. This could allow the discontinuance of Trains 277/278 and 286/287. The RDC should either have meal stops or snack service.

Does a potential exist for a Nakina-Hearst-Kapuskasing bus and/or RDC connection with Trains 128/129?

Yes, the layover at Winnipeg is long. However:

1. A potential delay factor for Trains 1,2,3,4,5,6 is eliminated.
2. Layover is in daytime in a major city. Lots to do.
3. How many people from northern Ontario are going through this connection now? The Winnipeg hook-up is vastly better than at Capreol. The trade-off is:
Number of west connections versus-
 - potential business, social travel for Toronto
 - potential overflow Toronto-Winnipeg travel in peak seasons
 - potential two-train schedule convenience Toronto-Sudbury-Winnipeg

Promotion: Sleepers - only lose one business day travel.

- enjoy a day of leisure.
- Friday night to Winnipeg, arrive before end of weekend. Ditto reverse.

Coaches and Sleepers - A folksy train. Friendly, comfortable. Have a cup of coffee with friends. Small train should mean crew mingling with passengers. Ads imply that crew thinks this train serves an important purpose.

THE LE
COURIER/COUREUR

2330	Lv. TORONTO	Ar.	0700
r2345	Lv. St. Clair Ave.	Ar.	0640d
0005	Lv. Maple -f-	Lv.	0620
0015	Lv. King -f-	Lv.	0610
0029	Lv. Aurora -f-	Lv.	0555
0040	Lv. Newmarket	Lv.	0547
0056	Lv. Bradford -f-	Lv.	0531
0116	Lv. Lefroy -f-	Lv.	0511
0140	Lv. Barrie	Lv.	0450
0217	Lv. Orillia	Lv.	0410
0242	Lv. Washago	Lv.	0345
0432	Lv. South Parry	Lv.	0155
0442	Lv. Parry Sound	Lv.	0135
0534	Lv. Bolger -f-	Lv.	0043
0830	Ar. SUDBURY *CN*	Lv.	2145
0835	Lv. SUDBURY *CN*	Ar.	2140
0910	Ar. Capreol	Lv.	2105
0955	Lv. Capreol	Ar.	2005
1201	Lv. Gogama	Lv.	1740
1405	Lv. Foleyet	Lv.	1605
1635	Lv. Oba	Lv.	1330
1735	Ar. Hornepayne	Lv.	1230
1755	Lv. Hornepayne	Ar.	1210
1855	Lv. Hillsport	Lv.	1050
2010	Lv. Longlac	Lv.	0930
2110	Ar. Nakina	Lv.	0850
2115	Lv. Nakina	Ar.	0845
@	Lv. Auden	Lv.	@
2255	Lv. Ferland	Lv.	0700
@	Lv. Mud River	Lv.	@
2355	Ar. Armstrong	Lv.	0605
0005	Lv. Armstrong	Ar.	0555
@	Lv. Collins	Lv.	@
@	Lv. Allanwater Br.	Lv.	@
0055	Lv. Savant Lake	Lv.	0455
0220	Ar. Sioux Lookout	Lv.	0130
0240	Lv. Sioux Lookout	Ar.	0110
0305	Lv. Hudson -f-	Ar.	0040
@	All points Sioux Lookout	@	@
@	to Winnipeg.	@	@
0425	Lv. Red Lake Road	Lv.	2310
0555	Lv. Redditt	Lv.	2135
0625	Lv. Minaki	Lv.	2105
0650	Lv. Malachi -f-	Lv.	2040
0750	Lv. Elma -f-	Lv.	1940
0850	Lv. Transcona -f-	Lv.	1845
0905	Ar. WINNIPEG	Lv.	1830

Trains 7 & 8 -

Baggage Car, Coach, Diner-Lounge, Sleeper.

Sleeper-Lounge running Toronto-Capreol in peak seasons.

Notes: @-stops on advance notice, d-discharge only, f-flag stop, r-receive only, *-taxi connection with CP station.

Selection 12

Least Cost Flows in a Capacitated Network: A Brazilian Example

H. L. Gauthier

A. PURPOSE

In the planning of a program of economic development, investments in transportation generally are regarded as safer than investments in directly productive activities. As Hirschman has observed, there is an attraction in investment ventures that are difficult to prove wrong before they are started or are unlikely to become obvious failures.¹ In Brazil, especially in the State of São Paulo, there is some indication that the development planners are following a course of action in which highway construction is a "lead" factor in the development process.

In an earlier study, the author found a high degree of relationship between the development of highway accessibility in one time period and the growth of manufacturing in a subsequent period.² The analysis of the highway network was in terms of graph theory, with the network being abstracted to a valued graph in which the connections between centers were weighted according to the cost of transporting a unit of commodity per unit of distance over laterite, gravel-surfaced, and paved highways. Although the type of road construction was a variable in the analysis of nodal accessibility to the network, no attempt was made to introduce a consideration of the capacities of the highways. A logical extension of the analysis would be a consideration of the spatial interaction between nodes in terms of the actual utilization of

the highway linkages. Unfortunately, origin-destination data have not been collected for Brazil's federal highways, much less the state of municipal roads. However, it is possible, given line-haul costs and capacities, to estimate the maximum flow at minimal costs between nodes in the network. The resulting theoretical flows are indicative of the potential for spatial interaction.

The purpose of this [work] is to determine the least cost flows in a capacitated network. To accomplish this objective, a network is abstracted as a graph and subjected to a search routine to determine the paths over which flow is probable between two centers. The out-of-kilter algorithm developed by D. Fulkerson is used to determine the maximum flow at minimal cost within the sub-networks delimited by the search routine. These procedures are applied to the São Paulo highway network of 1960, and some policy implications of the results are discussed.

B. LEAST COST FLOWS

Search Procedure

In determining the maximum flow at minimal cost in a network, there is a logical necessity to limit the paths utilized in the solution to the problem. Without such a restriction, computations generally are inefficient and lead to impractical results. Intuitively, it is improbable that flow will occur on all paths between a

given source and sink. This is especially true when those paths lead through intermediate nodes that are remote to a series of direct paths between the source and sink.

In the process of selecting shipment routes, long circuitous paths are uneconomic and if possible avoided. This does not mean the transport user is an optimizer. He does not select necessarily the least cost route, although his decision is made within a range of choices having definite economic limits imposed by the least cost path.

If $C = (c_1, c_2, \dots, c_n)$ is a set of costs such that some element of the set applies to each linkage in the network, the problem is to find

$$\begin{array}{ll} \min & [\sum c_{ij}] \\ X & x_i \in c \\ & x_j \in c \end{array}$$

where X is a set of nodes forming the end-points of paths from the source to the sink. Spatially the search is limited to a few paths forming a subset of the network.

Let x_s and x_t be the source and sink nodes respectively. Let the straight line distance between them be d_{st} and the length of the minimal cost path between them be v_{st} . Allowing v_{st} to be the distance from x_s and x_t for intermediate nodes to be included in the subset of the network, the search space is delimited as an ellipse with its foci at x_s and x_t (Fig. 12-1). It is the locus of points for which the sum of the distances from x_s to x_t is equal to v_{st} . That is,

$$(1) \quad v_1(x, y) + v_2(x, y) = v_{st}$$

The value v_{st} equals the major axis, $2a$, of the ellipse and establishes the coordinate points for the minor axis, $2b$. Assigning coordinate point designations to the nodes in the network, the sub-network includes all nodes that satisfy the relationship

$$(2) \quad \frac{x^2}{a^2} + \frac{y^2}{b^2} < 1$$

where

a = the length of the semimajor axis
 b = the length of the semiminor axis

The arcs connecting those nodes constitute the path sequence between x_s and x_t .

It is conceivable that an arc linking two nodes in the sub-network may intercept the boundary of the ellipse. To avoid creating a disconnected pair of nodes in the sub-network that are actually an ordered pair in the network, it is advisable to identify the spatial limits of the sub-network in terms of a circuit, the vertices of which are those nodes lying closest to the boundary of the ellipse.

The Out-of-Kilter Algorithm

The out-of-kilter algorithm for minimal cost flow problems generalizes the primal-dual transportation method so it may be initiated with an infeasible dual solution, as well as an infeasible primal solution.³ The method begins with an arbitrary flow, feasible or not, together with an arbitrary pricing vector and then uses a labeling procedure to adjust an arc of the network that fails to satisfy the

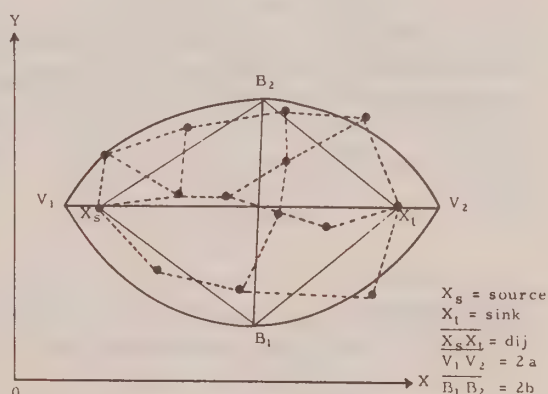


Fig. 12-1 Delimitation of a sub-network.

optimality properties.⁴ Dantzig regards the freedom to begin with any flow and pricing vector, rather than starting with particular ones that satisfy certain optimality properties, as the most attractive feature of the method.⁵ The algorithm keeps the relative cost factors non-negative while it works toward feasibility, so that when a feasible solution is obtained it will be optimal.

By definition a flow is a non-negative integral vector with components for each arc that satisfy the conservation equation

$$(3) \quad \sum_j (x_{ij} - x_{ji}) = 0 \quad (i, j = 1, \dots, n)$$

A flow is feasible if it satisfies the relation

$$(4) \quad l_{ij} \leq x_{ij} \leq u_{ij}$$

where

l_{ij} = a lower bound on the amount of flow
 u_{ij} = an upper bound on the amount of flow

A feasible flow that minimizes the cost

$$(5) \quad \sum_i \sum_j c_{ij} x_{ij}$$

over all feasible flows is optimal.

Let $\pi = (\pi_i)$ be a pricing vector of integers, one component for each node. The optimality properties for the problem are that

$$(6) \quad c_{ij} + \pi_i - \pi_j > 0 \rightarrow x_{ij} = l_{ij}$$

$$(7) \quad c_{ij} + \pi_i - \pi_j < 0 \rightarrow x_{ij} = u_{ij}$$

hold for all arcs ij . That is, if x is a feasible flow and there is a pricing vector π such that (6) and (7) hold, then x is optimal. The notation may be simplified by setting

$$(8) \quad \bar{c}_{ij} = c_{ij} + \pi_i - \pi_j$$

If, for a given flow x and a pricing vector π , an arc ij is in one of the following states:

$$(\alpha) \quad \bar{c}_{ij} > 0, x_{ij} = l_{ij}$$

$$(9) \quad (\beta) \quad \bar{c}_{ij} = 0, l_{ij} \leq x_{ij} \leq u_{ij}$$

$$(\gamma) \quad \bar{c}_{ij} < 0, x_{ij} = u_{ij}$$

it is considered in-kilter and the flow is optimal. If an arc is out-of-kilter it is in one of the following states:

$$(\alpha_1) \quad \bar{c}_{ij} > 0, x_{ij} < l_{ij}$$

$$(\beta_1) \quad \bar{c}_{ij} = 0, x_{ij} < l_{ij}$$

$$(10) \quad (\gamma_1) \quad \bar{c}_{ij} < 0, x_{ij} < l_{ij}$$

$$(\alpha_2) \quad \bar{c}_{ij} > 0, x_{ij} > l_{ij}$$

$$(\beta_2) \quad \bar{c}_{ij} = 0, x_{ij} > l_{ij}$$

$$(\gamma_2) \quad \bar{c}_{ij} < 0, x_{ij} > u_{ij}$$

To solve the problem it is necessary to get all arcs in-kilter.

For each state that an arc is in, there is a non-negative integer called the kilter number of the arc. An in-kilter arc has a kilter number of zero. Out-of-kilter arcs have positive kilter numbers that measure either the infeasibility of the arc flow or the degree to which the optimality properties (6) and (7) are not satisfied. To get all arcs in-kilter, Fulkerson uses a modified labeling procedure that searches for a flow-augmenting path from one node to another. The search procedure is carried out in such a way that all in-kilter arcs stay in-kilter, whereas the kilter number for any out-of-kilter arc either decreases or stays the same. Thus, all arc kilter numbers are monotone, non-increasing throughout the computation.

The labeling method terminates in one of two ways, called a breakthrough and a non-

breakthrough, respectively: either the sink receives a label, or no more labels can be assigned and the sink has not been labeled. If non-breakthrough results, it is impossible to increase the flow between the source and the sink. If a breakthrough occurs, a path from the origin to the sink can be flow-augmented, the increase in x being determined by the original out-of-kilter state of the arc. By alternative applications of the labeling and flow-augmenting process the kilter numbers are reduced to zero. When all arcs are in-kilter, the flow is feasible and optimal in terms of minimal costs.

THE SÃO PAULO NETWORK

Network as a Graph

The São Paulo highway network of 1960 is abstracted as a graph by regarding urban centers as a set of nodes (X), and the highway routes as a set of arcs (U). The incidence relationship between the two sets (Γ) is given by the pattern of connections existing in 1960. The resulting graph, $N = (X, U) = (X, \Gamma)$, is finite, oriented and connected. Associated with each arc are three non-negative integers: l_{ij} (the arc lower bound), u_{ij} (the arc upper bound), and c_{ij} (the arc cost).

Line Haul Costs

The obtainment of firm estimates of transportation costs in Brazil is a difficult undertaking at best. In large measure this is due to the fact that the trucking industry is characterized by a large number of very small firms. Fleet operations are the exception. In most cases, the driver is the vehicle owner, who seldom is knowledgeable of the accounting procedures necessary to establish actual operating expenses. Consequently, the values, c_{ij} , are based on average operating cost data supplied

by the Departamento Estradas de Rodagem do Estado de São Paulo, commonly called DER.

To estimate transfer costs as a function of distance, the procedure commonly employed by Brazilian transportation economists is the one suggested by Pires Ferreira.⁶ His procedure is based on the formulation

$$(11) \quad y^2 - D_1^2 x^2 - 2D_1 D_2 x - 2k = 0$$

where

y = the total costs

D_1 = the variable costs incurred by a vehicle traveling a distance

D_2 = the fixed overhead charges

$2k$ = initial outlays for equipment and administrative expenses; considered equal to the constant of integration multiplied by 2.

Allowing $C = -D_1^2$, $E = -(D_1 D_2)$, and $F = 2k$, Equation (9) can be rewritten as

$$(12) \quad y^2 + Cx^2 + Ex + F = 0$$

Thus we have a special case of the general second degree equation

$$(13) \quad Ay^2 + Bxy + Cx^2 + 2Dy + 2Ex + F = 0$$

In the manner of treating a conic section, we can determine the nature of the curve by the discriminant $\Delta = B^2 - 4AC$. When $B = 0$, $A = 1$, and $C = -D_1^2$, we have

$$(14) \quad \Delta = -C = D_1^2 > 0$$

Therefore, when $\Delta > 0$, equation (11) represents a hyperbola. Applying Pires' formulations to the data on average operating costs, we can derive a set of values that relate trans-

portation costs to length of haul over different road types (Table 12-1).

Arc Capacities

The values l_{ij} are set equal to zero, as there is no reason to assume any given highway will be included in the solution of the maximum flow-minimum cost problem. The values u_{ij} are considered equal to the capacities of the highways. The estimates of capacity are based on the formulations of the DER.⁷ The procedure employed is analogous to that developed by the Highway Research Board in the United States.

The maximum number of vehicles of a specified type which can pass over a highway during a twenty-four hour period, with consideration given to only speed, spacing interval, and surface type, constitutes the basic capacity of the road. From this basic capacity is derived an operational capacity with allowances for driver characteristics, essential vehicle maintenance en route, and unforeseen operational developments. Factors for highways characteristics, e.g., condition of road surface, width of motorable surface and

shoulders, curves and gradients, are applied to the operational capacity to obtain a practical daily capacity in vehicles per day. Assuming the use of five ton trucks hauling an average three ton load, the practical daily capacity is expressed in short tons per day.

The Via Anhanguera between São Paulo and Campinas, for example, is a four-lane divided highway with an all-weather surfacing of bituminous concrete. The DER estimates the basic capacity, with a 300-foot minimum vehicle spacing, to be 21,100 vehicles per day. Allowing a twenty percent reduction for driver characteristics, essential vehicle maintenance en route, and unforeseen operational developments, the operation capacity is estimated at 16,900 vehicles per day. The operational capacity is adjusted by considering the specific highway characteristics listed in Table 12-2. The result is a daily capacity of 14,544 vehicles for a two-way movement on the Via Anhanguera.

Half this figure represents the capacity for forward movement only. Assuming the use of five-ton trucks hauling an average three-ton load, the practical forward daily capacity is 21,816 short tons per day.

Table 12-1 The Relation of Transport Costs to Length of Haul

Distance (kms)	Cr\$/Ton		
	Paved	Gravel	Laterite
0	9.4	9.4	9.4
10	25.9	31.8	40.5
20	37.7	45.3	58.0
30	47.1	56.8	71.3
40	56.0	66.2	82.8
50	64.1	75.1	93.6
60	72.1	83.4	103.5
70	79.8	91.4	111.9
80	87.1	99.3	119.5
90	94.2	107.1	126.6
100	100.9	114.8	132.7

Results

For purposes of analysis, three nodes on the São Paulo highway network are considered alternately as sources and sinks. They are the urban centers of São Paulo, Ribeirão Preto, and Bauru. The selection of these nodes is based on their relative importance in the factor analytic dimensions of network accessibility.⁸ Of the more than 150 nodes of the 1960 highway network, São Paulo, Ribeirão Preto, and Bauru have the highest factor loadings on the principal dimensions of network accessibility. They are major foci for spatially distinctive clusters of nodes with similar structural patterns of direct and attenuated connectivity.

Table 12-2 Adjustment Factors for Highway Capacity

Characteristics	Via Anhanguera	Factor value
Width of motorable surface	42 feet	2.2
Shoulder width	6-12 feet	1.0
Highway alignment	Gradients less than 5 percent and curves not less than 150 ft. radius	0.9
Surface deterioration and maintenance	Surface condition is good and subsoil is moist	1.0
Turning and cross [~] movement	Controlled access	0.85
Operational phasing	Sustained movement	0.50

To delimit the geographic area to those paths most likely used between Ribeirão Preto and São Paulo, Bauru and São Paulo, and Bauru and Ribeirão Preto, the length of the minimal cost paths v_{ij} between the centers are determined.⁹ Between Ribeirão Preto and São Paulo the minimal path is 336 kilometers, and consists of the paved federal highways BR 106, from Ribeirão Preto to Limeira, and BR 33, from Limeira to São Paulo. Between Bauru and São Paulo, it is 360 kilometers, the distance between the two centers on the paved state highway. The minimal path between Bauru and Ribeirão Preto is 210 kilometers, and consists of a gravel road from Bauru to Jau, a bituminous treated road from Jau to São Carlos, and a gravel road from São Carlos to Ribeirão Preto (Fig. 12-2). Knowing v_{ij} , the major axes and the minor axes are determined for the ellipses delimiting the three sub-networks (Table 12-3). With Ribeirão Preto and Bauru as points of origin in Cartesian Grids, the coordinate positions of other nodes are determined. Nodes are included in the sub-networks if they satisfy Equation 2. Then the boundary of each ellipse is adjusted to identify a sub-network in terms of a circuit (Fig.

12-2). As a result, thirty nodes are included in the Ribeirão Preto-São Paulo sub-network, thirty in the Bauru-São Paulo sub-network, and eighteen in the Bauru-Ribeirão Preto sub-network. The sets of nodes in the sub-networks are not mutually exclusive (Table 12-4).

Within a sub-network, each arc has associated with it the cost of a unit of flow and the capacity constraints on that flow. Applying the out-of-kilter algorithm, the maximum flow at minimal cost is determined for the capacitated sub-networks (Tables 12-5, 12-6, 12-7). In all three cases there is a feasible flow and the optimality requirements of Equations (6) and (7) are satisfied. Given the existing connections between Ribeirão Preto and São Paulo, the maximum flow is 12,140 short tons per day at a cost of Cr\$5,577,256. For the Bauru-São Paulo sub-network, the maximum flow is 14,954 short tons at a cost of Cr\$6,836,209. For the Bauru-Ribeirão Preto sub-network, it is 5,666 short tons at a cost of Cr\$2,084,079. On a ton-kilometer basis, the comparable costs are Cr\$1.19 t/klm (São Paulo-Bauru), Cr\$1.32 t/klm (Ribeirão Preto-São Paulo) and Cr\$1.50 t/klm (Bauru-Ribeirão Preto).

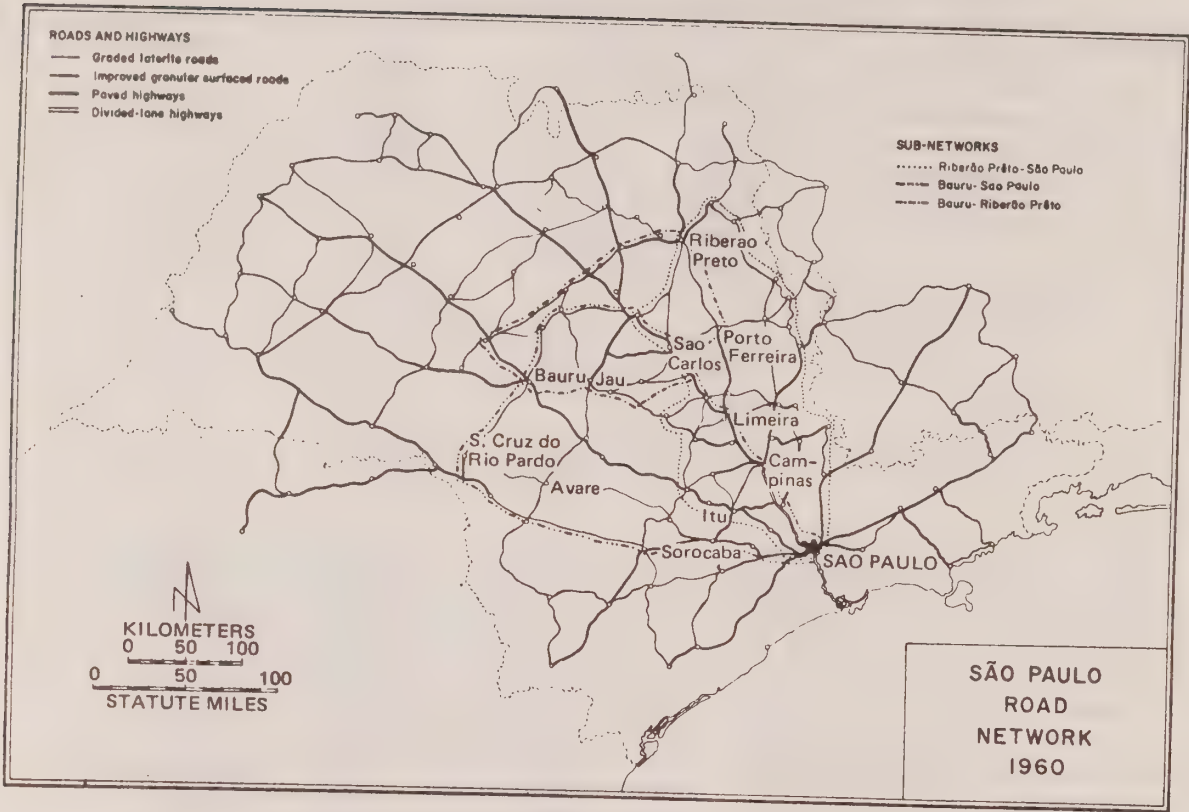


Fig. 12-2.

C. INTERPRETATION

The maximum flows between Ribeirão Preto and São Paulo, and between Bauru and São Paulo, are in accord with expectations. Since 1955, highway construction in the State of São Paulo has been characterized by a con-

tinual increase in bituminous concrete and bituminous surface-treated highways. The Plano de Ação of the State Government, for the period 1958-62, called for the replacement of many gravel-surfaced arterial roads with paved ones. The objective was to reduce transport costs which are a major component

Table 12-3 Values for the Ellipses

Source	Sink	D_{ij} (klm)	Major axis 2 (klm)	Minor axis 2 (klm)
Ribeirão Preto	São Paulo	295	336	191
Bauru	São Paulo	280	360	234
Bauru	Ribeirão Preto	180	210	176

Table 12-4 Nodes in the Sub-networks*

Ribeirão Preto-São Paulo	Bauru-São Paulo	Bauru-Ribêrao Preto
Ribeirão Preto	Bauru	Bauru
Batatais	Iacanga	Pirajui
Altinópolis	Ibitinga	Iacanga
Mococa	Jau	Jau
S. José do Rio Pardo	S. Cruz do Rio Pardo	Dois Corregos
Casa Branca	E	D
Vargem Grande	Piraju	Ibitinga
S. João da Boa Vista	Itai	Itapolis
A	Avaré	C
Porto Ferreira	São Manuel	Araraquara
Araraquara	Dois Corregos	Matão
São Carlos	D	Jaboticabal
Rio Claro	Araraquara	B
Araras	São Carlos	São Carlos
Mogi Mirim	B	Porto Ferreira
Itapira	São Pedro	A
Socorro	Rio Claro	Sertãozinho
Amparo	Limeira	Ribeirão Preto
Jaquariuna	Piracicaba	
Limeira	Americana	
São Pedro	Campinas	
Piracicaba	Capivari	
Americana	Tietê	
Campinas	Tatui	
Tietê	Itapetininga	
Capivari	Sorocaba	
Jundiaí	Itu	
Bragança Paulista	Jundiaí	
Itu	São Roque	
São Paulo	São Paulo	

*Dummy nodes, indicated by alphabetic characters, are included to maintain a topologically planar network.

in the consumer prices of commodities, and thus a restrictive factor on the rate of economic growth.¹⁰ Much of the new construction, as well as the upgrading of existing roadways, either focused directly on São Paulo or was in the form of extensions to roads which focused on São Paulo. As a consequence, the capital city has been connected with the major regional centers of the State, including Ribeirão Preto and Bauru, by high capacity, low cost highways.

With respect to São Paulo's connections to the regional centers there are some bottle-

necks that restrict the utilization of the high capacity highways, and they may be forcing the planners to follow a program of induced decision making in setting their priorities. For example, the Via Anhanguera has an existing capacity of about 22,000 short tons per day. Yet the maximum flow between Ribeirão Preto and São Paulo, which to a large extent passes over the Via Anhanguera, is only slightly more than 12,000 short tons per day. As evident in Table 12-5, there are bottlenecks in the system that, in several instances, restrict the utilization of this high capacity

Table 12-5 Least Cost Flows in Ribeirão Prêto – São Paulo Sub-network

Arcs (i, j)	Cost c_{ij} (cruz- eiros)	Upper Capa- city u_{ij} (short tons)	Lower Capa- city l_{ij} (short tons)	Flow* x_{ij} (short tons)
Ribeirão Prêto – Batatais	51	5498	0	1107
Ribeirão Prêto – A	74	2306	0	2306
Ribeirão Prêto – Porto Ferreira	96	8727	0	8727
Batatais – Altinópolis	59	1476	0	1107
Altinópolis – Mococa	95	1107	0	1107
Mococa – S.J. do Rio Pardo	66	536	0	0
Mococa – Casa Branca	64	1230	0	1107
S.J. do Rio Pardo – Casa Branco	54	1093	0	0
S.J. do Rio Pardo – Vargem Grande	63	1230	0	0
Casa Branca – Vargem Grande	48	1661	0	0
Casa Branca – Porto Ferreira	72	1661	0	0
Casa Branca – Mogi Mirim	108	1845	0	1107
Vargem Grande – S.J. da Boa Vista	50	1476	0	0
S.J. da Boa Vista – Mogi Mirim	80	7757	0	0
A – Araraquara	66	2306	0	0
A – São Carlos	72	2306	0	2306
Porto Ferreira – São Carlos	74	1661	0	0
Porto Ferreira – Rio Claro	73	8727	0	8727
Araraquara – São Carlos	53	10774	0	0
São Carlos – Rio Claro	93	9696	0	2306
Araras – Rio Claro	59	803	0	0
Rio Claro – Limeira	38	9696	0	2306
Rio Claro – São Pedro	79	1661	0	0
Rio Claro – Piracicaba	70	1084	0	0
Araras – Mogi Mirim	76	1661	0	1337
Araras – Limeira	42	8727	0	7390
Mogi Mirim – Itapira	36	5498	0	0
Mogi Mirim – Jaquariuna	47	8727	0	2444
Mogi Mirim – Limeira	79	1661	0	0
Itapira – Amparo	80	803	0	0
Amparo – Socorro	70	3665	0	0
Socorro – Bragança Paulista	76	1107	0	0
Amparo – Jundiaí	81	4887	0	0
Jaquariuna – Amparo	48	4887	0	0
Jaquariuna – Campinas	39	8727	0	2444
Limeira – Piracicaba	60	1868	0	0
Limeira – Americana	38	9696	0	9696
São Pedro – Piracicaba	75	2076	0	0
Piracicaba – Americana	47	6109	0	0
Piracicaba – Tietê	68	1661	0	0
Americana – Campinas	53	9696	0	9696
Campinas – Jundiaí	56	21816	0	12140
Campinas – Itu	75	1661	0	0
Capivari – Campinas	65	8727	0	0

Table 12-5 (continued)

Tiete-Capivari	61	1845	0	0
Tiete-Itu	66	8727	0	0
Capivari-Itu	85	1084	0	0
Jundiai-São Paulo	71	21816	0	12140
Bragança Paulista-São Paulo	94	7757	0	0
Itu-São Paulo	101	8727	0	0

Total flow... 12,140 short tons per day

Total cost... CR\$5,577,256

*All kilter numbers are zero.

Node	Node Prices		Node	π
	π			
Ribirão Preto	0	Itapira	413	
Batatais	51	Socorro	472	
Altinópolis	110	Amparo	542	
Mococa	205	Jaquariuna	424	
S. José do Rio Pardo	271	Limeira	343	
Casa Branca	269	São Pedro	384	
Vargem Grande	317	Piracicaba	375	
S. José do Boa Vista	367	Americana	410	
Node "A"	140	Campinas	463	
Porto Ferreira	228	Capivari	504	
Araraquara	206	Tiete	443	
São Carlos	212	Jundiai	519	
Araras	301	Bragança Paulista	590	
Rio Claro	305	Itu	509	
Mogi Mirim	377	São Paulo	590	

route and result in flows being forced onto higher cost paths. One major restriction is the connection between Limeira and Campinas which has a capacity of only 9,700 short tons per day. In the maximum flow solution, it is saturated and forces the diversion of flow from Ribirão Preto to São Paulo by way of relatively high cost routes, e.g., the path from Araras to Jaguariuna to Campinas. Although the highway plan of 1958 did not specify an extension of the Via Anhanguera at this time, the present plans of the DER call for the ex-

tension of the divided four-lane highway from Campinas to Limeira, and eventually to Ribirão Preto. The result of this decision to eliminate an obvious bottleneck will be a doubling of the maximum flow between Ribirão Preto and São Paulo and an additional reduction in costs (Table 12-8).

The maximum flow in the Bauru-Ribirão Preto sub-network is interesting. Not only is it considerably less than that in the other sub-networks, its costs per ton-kilometer are the highest, even though the distance between the

Table 12-6 Least Cost Flows in Bauru-São Paulo Sub-network

Arcs (<i>i, j</i>)	Cost c_{ij} (cruz- eiros)	Upper Capa- city u_{ij} (short tons)	Lower Capa- city l_{ij} (short tons)	Flow* x_{ij} (short tons)
Bauru-Iacanga	79	1845	0	1845
Bauru-Jau	83	2076	0	2076
Bauru-S. Cruz do Rio Pardo	103	2306	0	2306
Bauru-São Manuel	84	8738	0	8727
Iacanga-Ibitinga	46	1845	0	1845
Ibitinga-Jau	113	957	0	0
Ibitinga-Araraquara	91	1845	0	1845
Jau-São Manuel	71	1537	0	0
Jau-Dois Corregos	58	2076	0	2076
Jau-D	44	6787	0	0
S. Cruz do Rio Pardo-E	35	6787	0	1235
S. Cruz do Rio Pardo-Avaré	127	1071	0	1071
E-Piraju	47	6109	0	1235
Piraju-Itai	68	2076	0	1235
Itai-Itapetininga	143	2076	0	1235
Avaré-Itai	71	1661	0	0
Avaré-São Manuel	83	1845	0	0
Avaré-Tatui	155	1061	0	1071
São Manuel-Teite	118	8727	0	8727
Dois Corregos-B	90	1661	0	1661
Dois Corregos-São Pedro	95	1868	0	415
D-Araraquara	52	6787	0	0
D-São Carlos	81	6787	0	0
Araraquara-São Carlos	53	10774	0	1845
São Carlos-B	51	10774	0	1845
B-Rio Claro	42	9696	0	3506
São Pedro-Rio Claro	79	1661	0	0
São Pedro-Piracicaba	75	2076	0	415
Rio Claro-Limeira	38	9696	0	3506
Rio Claro-Piracicaba	70	1084	0	0
Limeira-Americana	38	9696	0	3506
Piracicaba-Limeira	60	1868	0	0
Piracicaba-Americana	47	6109	0	415
Piracicaba-Tiete	68	1661	0	0
Americana-Campinas	53	9696	0	3921
Campinas-Itu	75	1661	0	0
Campinas-Jundiaí	56	21816	0	3921
Capivari-Campinas	65	8727	0	0
Capivari-Itu	85	1084	0	0
Tiete-Capivari	61	1845	0	0
Tiete-Itu	66	8727	0	8727
Tatui-Tiete	60	1661	0	0
Tatui-Sorocaba	79	2076	0	1071
Itapetininga-Tatui	69	1730	0	0

Table 12-6 (continued)

(i, j)	c_{ij}	u_{ij}	l_{ij}	x_{ij}
Itapetininga-Sorocaba	75	8727	0	1235
Sorocaba-Itu	60	8727	0	0
Sorocaba-São Roque	56	8727	0	2306
Itu-Jundiaí	54	8727	0	0
Itu-São Paulo	101	8727	0	8727
Jundiaí-São Paulo	71	21816	0	3921
São Roque-São Paulo	72	8727	0	2306
Total flow = 14,954 short tons per day				
Total cost = CR\$6,836,209				

* All kilter numbers are zero.

Node prices

Node	π	Node	π
Bauru	0	São Pedro	316
Iacanga	79	Rio Claro	362
Ibitinga	125	Limeira	400
Jau	163	Piracicaba	391
S. Cruz do Rio Pardo	122	Americana	438
Node "E"	157	Campinas	491
Piraju	204	Capivari	512
Itai	272	Tietê	451
Avaré	256	Tatui	411
São Manuel	234	Itapetininga	415
Dois Corregos	221	Sorocaba	490
Node "D"	207	Itu	517
Araraquara	216	Jundiaí	547
São Carlos	269	São Roque	546
Node "B"	320	São Paulo	618

centers is less. Obviously, the construction program under the Plano de Ação has not resulted in the same improvement in transportation between these two regional centers as it has between them and São Paulo. This is somewhat surprising in view of the expressed desire of the State Government to provide infrastructure that will increase the attractiveness of the regional centers as locations for industry, which has tended in the past to concentrate in the São Paulo metropolitan area. It is virtually impossible for this objec-

tive to be achieved under a program that provides high capacity, low cost connections between the regional centers and São Paulo, but not between the regional centers themselves. Such a program only increases the attractiveness of the São Paulo metropolitan area as an industrial location, and at the expense of the regional centers.

Increasingly aware of the difficulties involved in establishing the regional centers as secondary targets for the factor movements of labor and capital that have focused on São

Table 12-7 Least Cost Flows in Bauru-Riberão Prêto Sub-network

Arcs (i, j)	Cost c_{ij} (cruz- eiros)	Upper Capa- city u_{ij} (short tons)	Lower Capa- city l_{ij} (short tons)	Flow* x_{ij} (short tons)
Bauru-Pirajui	67	6787	0	1845
Bauru-Iacanga	79	1845	0	1845
Bauru-Jau	83	2076	0	2076
Pirajui-Iacanga	105	1147	0	0
Pirajui-Itapolis	101	1845	0	1845
Iacanga-Ibitinga	46	1845	0	1845
Jau-Dois Corregos	58	2076	0	0
Jau-D	44	6787	0	2076
Jau-Ibitinga	113	957	0	0
Dois Corregos-B	90	1661	0	0
D-Araraquara	52	6787	0	2076
D-São Carlos	81	6787	0	0
Ibitinga-Itapolis	59	820	0	0
Ibitinga-Araraquara	91	1845	0	1845
Itapolis-C	50	1845	0	1845
C-Jaboticabal	63	1845	0	1845
Araraquara-Matão	45	10774	0	1615
Araraquara-A	66	2306	0	2306
Matão-C	47	10774	0	0
Matão-Jaboticabal	57	6109	0	1615
Jaboticabal-Sertãozinho	51	5498	0	3460
B-São Carlos	51	10774	0	0
São Carlos-Porto Ferreira	74	1661	0	0
São Carlos-A	72	6787	0	0
São Carlos-Araraquara	53	10774	0	0
Porto Ferreira-Riberão Prêto	96	8727	0	0
A-Riberão Prêto	74	2306	0	2306
Sertãozinho-Riberão Prêto	38	5498	0	3460

Total flow = 5,766 short tons per day
Total cost – CR\$2,084,079

* All kilter numbers are zero.

Node Prices

Node	π
Bauru	0
Pirajui	67
Iacanga	172
Jau	213
Dois Corrego	271
Node "D"	257

Table 12-7 (continued)

Node Prices	
Node	π
Ibitinga	218
Itapolis	277
Node "C"	348
Araraquara	309
Matão	354
Jaboticabal	411
Node "B"	361
São Carlos	338
Porto Ferreira	412
Node "A"	410
Sertãozinho	462
Ribirão Preto	500

Paulo, the State Government is concerned that the spatial interaction between the regional centers be improved. An indication of

this concern are two proposals in the present plans of the DER to improve highway connections between Bauru and Ribirão Preto. The gravel road from Bauru to Jau will be paved, increasing its capacity from approximately 2,000 short tons per day to over 6,000. Also, the gravel road from São Carlos to Ribirão Preto will be upgraded by bituminous surfacing, increasing its capacity from 2,500 short tons per day to 5,500. The results of both projects will be to increase the maximum flow between the centers by over forty percent and to reduce substantially the average transportation costs (Table 12-8). Theoretically, these improvements should help create conditions that increase the attractiveness of the two centers as foci for capital investments, given the permissive role of transportation in the process of economic development. How-

Table 12-8 Highway Changes and Their Effect on Least Cost Flows

Sub-network	Flow (short tons)	Cost (cruzeiros)		
		Total	Per unit flow	Per ton- kilometer
I. Ribirão Preto - São Paulo				
A. Present network	12,140	5,577,256	459.41	1.32
B. Addition: four lane divided highway Campinas to Limeira	25,229	11,362,405	450.37	1.29
II. Bauru - São Paulo				
Present network	14,954	6,836,209	457.14	1.19
III. Bauru - Ribirão Preto				
A. Present network	5,766	2,084,079	361.44	1.50
B. Addition: paved high- way Bauru to Jau	9,465	3,386,440	357.78	1.42
C. Addition: paved high- way São Carlos to Ribirão Preto	9,799	3,356,930	342.58	1.40
IV. São Paulo - Bauru - Ribirão Preto				
A. Present network	25,158	11,653,437	463.21	1.23
B. Addition: paved high- ways Bauru to Jau and São Carlos to Ribirão Prêto	25,158	11,296,907	448.34	1.09

ever, this may prove to be an unwarranted expectation.

As the sub-networks are not mutually exclusive sets, the proposed improvements in highway conditions between Bauru and Ribeirão Preto involve arcs contained in the other sub-networks; the Bauru-Jau arc is in the Bauru-São Paulo sub-network and the São Carlos-Ribeirão Preto arc is in the Ribeirão Preto-São Paulo sub-network. Considering the two sub-networks jointly, with São Paulo being a common source node, we can consider the proposed highway improvements in terms of their effect on flows between São Paulo and the two regional centers.¹¹ From Table 12-8, it is apparent that the improvements, while they do not increase the flow between São Paulo and the regional centers, do affect the cost of the maximum flow. Indeed, the cost reductions are greater than they are between Bauru and Ribeirão Preto. Thus, one consequence of the plan to improve the potential for spatial interaction between the two regional centers will be a greater reduction in the transport barrier between those centers and the growth pole of São Paulo. This should increase the locational advantages of São Paulo relative to the regional centers.

The advantages accruing to São Paulo as a result of highway improvements in the Bauru-Ribeirão Preto sub-network do not mean necessarily that the proposed changes should be abandoned. Obviously, other benefits resulting from transportation improvement must be taken into account in determining the advisability of the construction program. However, the results do emphasize the necessity of considering improvements in a transportation linkage in terms of their system-wide impact and not just in terms of the two centers situated at their endpoints. In

this regard, the determination of least cost flows in a capacitated network can be most instructive.

NOTES

- 1 A. O. Hirschman. *The Strategy of Economic Development*. New Haven: Yale University Press, 1958, Chapter 5.
- 2 H. L. Gauthier. "Transportation and the Growth of the São Paulo Economy." *Journal of Regional Science*, Vol. 8, No. 1, pp. 1-18.
- 3 L. Ford and D. Fulkerson. *Flows in Networks*. Princeton: Princeton University Press, Chapter 3.
- 4 For a detailed discussion of the labeling process, see Ford and Fulkerson, *op. cit.*, Chapter 1.
- 5 George Dantzig. *Linear Programming and Extensions*. Princeton: Princeton University Press, 1963, p. 404.
- 6 Jurandyr Pires Ferreira. "Teoria Racional das Tarifas." *Revista do DER*, Vol. XXIV, No. 87/88, December, 1963, pp. 45-68.
- 7 Renato de Sousa Nogueira. "Capacidade de Tráfego das Estradas." *Revista do DER*, Vol. XVI, No. 58, March, 1950, pp. 116-122.
- 8 H. Gauthier. *op. cit.*, pp. 12-13.
- 9 This is accomplished by a minor modification in the out-of-kilter algorithm. To construct a feasible flow from x_s to x_t of a given value v that minimizes Equation (4), one adds a return flow arc t, s with $l_{ts} = u_{ts} = v$, and $c_{ts} = 0$ to get the problem in a circulation form. When $v = 1$ and for all arcs, other than t, s , $u_{ij} = 1$, $l_{ij} = 0$, and c_{ij} equals the line-haul cost between x_i and x_j , the algorithm yields the minimal spanning tree from x_s to x_t .
- 10 The Joint Brazil-United States Economic Development Commission. *Brazilian Technical Studies*, Washington: Institute of Inter-American Affairs, 1955, p. 265.
- 11 The problem of considering multiple sinks can be simplified by reducing the problem to the case of a single source and sink. See Ford and Fulkerson, *op. cit.*, pp. 15-17.

● SEX OF RESPONDANTS

	No.	%
FEMALE	26	53.1
MALE	22	44.9
UNKNOWN	<u>1</u>	<u>2.0</u>
TOTAL	49	100.0

● TRANSPORT MODE

	No.	%
TRAIN	45	64.3
CAR	18	25.7
TRUCK	3	4.2
BUS	2	2.9
PLANE	<u>2</u>	<u>2.9</u>
TOTAL	70	100.0

● TRANSPORT MODE (INTERMODALBREAKDOWN)

	No.	%
TRAIN	27	55.1
CAR, TRAIN	13	26.5
TRAIN, TRUCK	3	6.1
BUS, CAR, TRAIN	2	4.1
CAR	2	4.1
CAR, PLANE, TRAIN	<u>2</u>	<u>4.1</u>
TOTAL	49	100.0

● DID YOU KNOW ABOUT VIA TRAIN ?

	No.	%
YES	48	98.0
NO	<u>1</u>	<u>2.0</u>
TOTAL	49	100.0

① HOW MANY TIMES DO YOU USE THE
TRAIN?

	No.	%
2 / MO	8	16.3
6 / YR	7	14.3
4 / MO	4	8.2
1 / MO	3	6.1
3 / MO	3	6.1
8 / YR	3	6.1
5 / YR	2	4.1
3 / YR	2	4.1
2 / YR	2	4.1
4 / YR	2	4.1
10 / YR	1	2.0
8 / MO	1	2.0
20 / MO	1	2.0
6 / MO	1	2.0

(CONT)

(CONT)

UNKNOWN	9	18.4
TOTAL	49	99.9

6-DAY A WEEK SERVICE IS IT ENOUGH?

	NO	%
YES - REGULAR	17	34.7
OTHER	4	8.2
UNKNOWN	2	4.1
NO - REGULAR	3	6.1
OTHER	12	24.5
UNKNOWN	5	10.2
NO RESPONSE	6	12.2
TOTAL	49	100.0

● 3 - DAYS A WEEK ?

	No.	%
YES - REGULAR	9	18.4
OTHER	1	2.0
UNKNOWN	1	2.0
NO - REGULAR	13	26.5
OTHER	15	30.6
UNKNOWN	5	10.2
NO RESPONSE	<u>5</u>	<u>10.2</u>
TOTAL	49	99.9

● 1 DAY A WEEK ?

YES - REGULAR	0	0 %
OTHER	0	0
UNKNOWN	0	0
NO - REGULAR	14	28.6
OTHER	15	30.6
UNKNOWN	4	8.2
NO RESPONSE	16	32.7
TOTAL	49	100.1

● 2 DAY A WEEK ?

YES - REGULAR	0	0 %
OTHER	0	0
UNKNOWN	0	0
NO - REGULAR	13	26.5
OTHER	15	30.6
UNKNOWN	4	8.2
NO RESPONSE	17	34.7 (CONT)

(CONT)

TOTAL	49	100.0%
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● ARE FARES RIGHT ?

	No.	%
YES - REGULAR	17	34.7
OTHER	13	26.5
TOO HIGH - REGULAR	16	12.2
OTHER	2	4.1
TOO LOW - REGULAR	0	0
OTHER	0	0
INSUFFICIENT DATA	<u>11</u>	<u>22.4</u>
TOTAL	49	99.9

● IS \$4 MINIMUM FARE TOO HIGH?

	No.	%
YES - REGULAR	7	14.3
OTHER	2	4.1
NO - REGULAR	12	24.5
OTHER	9	18.4
INSUFFICIENT DATA	19	38.8
TOTAL	49	100.1

● IS \$8 MINIMUM

	No.	%
YES - REGULAR	7	14.3
OTHER	4	8.2
NO - REGULAR	13	26.5
OTHER	6	12.2
INSUFFICIENT DATA	19	38.8
TOTAL		100.0

● AGE OF RESPONDANTS

	No.	%
0 - 19	1	2.0
20 - 29	9	18.4
30 - 39	6	12.2
40 - 49	8	16.3
50 - 59	9	18.4
60 +	15	30.6
Unknown	1	2.0
TOTAL	49	99.9

● WHY DO YOU USE THE TRAIN ?

0 - 19 :

WORK	0	0%
SHOPPING	1	33.3
DOCTOR	0	0
HOSPITAL	0	0
RELATIVE	1	33.3
RECREATION	1	33.3
OTHER	0	0
TOTALS	3	99.9%

20 - 29 :

WORK	3	9.7
SHOPPING	7	22.7
DOCTOR	5	16.1
HOSPITAL	5	16.1
RELATIVE	7	22.7
RECREATION	3	9.7
OTHER	1	3.2
TOTAL	31	100.2%

30 - 39

WORK	3	15.8
SHOPPING	3	15.8
DOCTOR	3	15.8
HOSPITAL	2	10.5
RELATIVE	6	31.6
RECREATION	2	10.5
OTHER	0	0
TOTAL	19	100 %

40 - 49 :

WORK	1	3.3127
SHOPPING	7	21.9
DOCTOR	7	21.97
HOSPITAL	6	18.8
RELATIVE	7	21.97
RECREATION	2	6.3
OTHER	2	6.35
TOTAL	32	100.2%

50 - 59 :

WORK	2	5.4
SHOPPING	7	18.9
DOCTOR	8	21.6
HOSPITAL	6	16.2
RELATIVE	7	18.9
RECREATION	4	10.8
OTHER	3	8.1
TOTAL	37	99.9%

60 +

WORK	0	0%
SHOPPING	6	14.0
DOCTOR	10	23.3
HOSPITAL	9	20.9
RELATIVE	9	20.9
RECREATION	8	18.6
OTHER	1	2.3
TOTAL	43	100.0%

